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⑭表示方法

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明　　細　　書

1　発明の名称

表　示　方　法

2　特許請求の範囲

① 半導体メモリにデジタル情報を書き込むときおよび前記半導体メモリのデジタル情報を読み出すときに、前記半導体メモリの現在アドレス，最終アドレスなどのアドレス情報と、前記半導体メモリのアクセス速度情報とにより、前記半導体メモリのアクセス残量を時間に変換した残り時間、またはアクセス済み量を時間に変換した済み時間、または前記両時間を演算し、前記残り時間による表示、または前記済み時間による表示、または前記両時間による表示を行なうことを特徴とする表示方法。

3　発明の詳細な説明

この発明は、たとえば、記録音声をデジタル変換して記憶するとともに、記憶したデジタル情報をアナログ変換して再生音声を出力する記憶装置に用いられる半導体メモリのアクセス残量、またはアクセス済み量、または前記両量を表示する表示方法に関し、アクセス残量、またはアクセス済み量、または前記両量を時間に変換して表示することを目的とする。

従来、記録媒体としてカセットテープ，オープンリールテープなどの磁気テープを用いる音声信号の記憶装置は、記録，再生，早送りなどを行なう場合、一般に、一方のリール側のテープ量と他方のリール側のテープ量の変化を直接目で見ることができ、記録，再生，早送りなどの残り時間および済み時間を容易に知ることができる。しかし、途中状態から記録，再生，早送りなどを開始したときは、途中状態からの済み時間などを知ることは困難である。

一方、音声や音楽などをデジタル情報に変換して記憶するとともに、記憶したデジタル情報をアナログ変換して再生音声や再生音などを出力する記憶装置には、記録媒体としてデジタル情報の書き込みおよび読み出しを行なう半導体メモリを用いるものがあり、該半導体メモリをアクセスして

記録，再生，早送りおよびチエックなどを行なう場合、半導体メモリのアクセス状況を目で見ることが不可能であるため、記録，再生，早送りおよびチエックなどの残り時間および済み時間を知ることが困難である。

なお、半導体メモリのパッケージの記載または半導体メモリの実際の使用による推測から半導体メモリの容量を知ることは可能であるが、半導体メモリの書き込みおよび読み出しなどに要する時間が、半導体メモリのアクセス時間およびアクセス方法などにより異なるため、半導体メモリの容量から残り時間および済み時間を知ることは不可能である。

また、記憶装置には、半導体メモリの着脱が自在に行なえるカセット方式のものと、半導体メモリの着脱が不可能な固定式のものとがある。

この発明は、前記の点に留意するとともに、一般に、半導体メモリの書き込みおよび読み出しに要する時間が、半導体メモリの容量とアクセス時間で決定されることに着目してなされたものであり、半導体メモリにデジタル情報を書き込むときおよび前記半導体メモリのデジタル情報を読み出すときに、前記半導体メモリの現在アドレス，最終アドレスなどのアドレス情報と、前記半導体メモリのアクセス速度情報とにより、前記半導体メモリのアクセス残量を時間に変換した残り時間、またはアクセス済み量を時間に変換した済み時間、または前記両時間を演算し、前記残り時間による表示、または前記済み時間による表示、または前記両時間による表示を行なうことを特徴とする表示方法である。

したがって半導体メモリを使用した記憶装置の記録，再生，早送り，チエックなどを行なうときに、アクセスの残り時間または、アクセスの済み時間、または前記両時間の表示により、記録，再生，早送り，チエックなどの残り時間、または済み時間、または前記両時間を知ることができ、とくに、半導体メモリを使用して音声や音楽などを記憶する記憶装置に極めて有効な表示方法を提供することができるものである。

つぎに、この発明の表示方法をその1実施例を示した図面とともに説明する。

図面において、(1)は記録用の音声信号を出力するマイク、(2)はデジタル変換およびアナログ変換を行なう変換器であり、マイク(1)の音声信号を変換してデジタル音声情報を出力する。(3)はデータバス(4)を介した変換器(2)のデジタル音声情報が書き込まれる半導体メモリであり、たとえば128キロビットの容量を有し、該メモリ(3)から読み出されたデジタル音声情報は、データバス(4)を介して変換器(2)に入力され、該変換器(2)によりアナログ変換される。(5)は変換器(2)のアナログ変換により形成された再生用の音声信号が入力されるスピーカであり、スピーカ(5)から再生音声および再生音などが出力される。

また、(6)は半導体メモリ(3)をアクセスするためのアドレス信号を出力するカウンタであり、カウンタ(6)のアドレス信号がアドレスバス(7)を介して半導体メモリ(3)に入力される。(8)はアドレス信号を形成するためのクロック信号を出力するクロック発生器、(9)はカウンタ(6)とクロック発生器(8)の間に設けられたスイッチであり、記録，再生，早送り，チエックなどの際に閉路し、クロック信号をカウンタ(6)に送出する。(10)は10進キーボードなどからなるアドレス入力器であり、半導体メモリ(3)の所望の途中アドレスから該メモリ(3)のアクセスを開始する際に、前記所望の途中アドレスに対応するアドレス信号を初期形成してカウンタ(6)に出力し、カウンタ(6)の初期設定を行なう。

さらに、(11a),(11b),…は半導体メモリ(3)の容量に従つて選択的に操作される複数の容量設定スイッチ、(12a),(12b),…は半導体メモリ(3)のアクセス速度を設定するための複数の速度設定スイッチ、(13)はアドレスバス(7)を介したアドレス信号および各スイッチ(11a),(11b),…,(12a),(12b),…のスイッチ信号が入力される演算処理回路であり、速度スイッチ(12a),(12b),…それぞれのキー信号に対応したクロック制御信号をクロック発生器(8)に出力し、クロック信号の周波数を制御してカウンタ(6)からのアドレス信号の出力タイミングを制

御するとともに、半導体メモリ(3)のアクセス残量を時間に変換した残り時間、または半導体メモリ(3)のアクセス済み量を時間に変換した済み時間、または両時間を演算して出力する。(14)は演算処理回路(13)の表示信号が入力される時間表示部であり、前述の残り時間、または済み時間、または両時間を表示する。

なお、半導体メモリ(3)に書き込まれるデジタル音声情報、および半導体メモリ(3)から読み出されたデジタル音声情報の並列/直列変換回路などは省略されている。

そして半導体メモリ(3)を記憶装置に装着し、半導体メモリ(3)の容量に対応する容量設定スイッチ(11a),(11b),…のキー信号により、演算処理回路(13)に、半導体メモリ(3)の容量にもとづく最終アドレスを入力するとともに、所定の速度設定スイッチ(12a),(12b),…のキー信号により、演算処理回路(13)に、半導体メモリ(3)の書き込みおよび読み出しのアクセス速度情報，たとえば2400ビット/秒のアクセス速度情報を入力する。

なお、速度設定スイッチ(12a),(12b),…のキー信号にもとづき、クロック発生器(8)からカウンタ(6)に出力されるクロック信号の周波数が設定される。

また、アクセス速度が2400ビット/秒に設定されたときは、半導体メモリ(3)の容量が128キロビットであれば、半導体メモリ(3)のすべての書き込みまたは読み出しに要する時間が約53秒になる。

つぎに、記録，再生，早送り，チェックなどを行なうために、記録，再生，早送り，チェックなどのモードスイッチ（図示せず）を操作すると、カウンタ(6)からアドレスバス(7)を介して半導体メモリ(3)に出力されるアドレス信号により、半導体メモリ(3)がアクセスされるとともに、アドレスバス(7)のアドレス信号が演算処理回路(13)に入力される。

そして演算処理回路(13)により、最終アドレスから現在アドレスを減算するとともに該減算結果を速度情報で除算して半導体メモリ(3)のアクセス残量を時間に変換した残り時間を演算したり、現在アドレスを速度情報で除算して半導体メモリ(3)のアクセス済み量を時間に変換した済み時間を演算したり、または、両時間を演算したりする。

さらに、演算処理回路(13)の表示信号により、時間表示部(14)に、演算した残り時間、または済み時間、または両時間が表示される。

そこで時間表示部(14)の表示時間により、記録，再生，早送り，チェックなどの残り時間、または済み時間、または両時間を知ることができる。

なお、前記実施例では、記憶装置に容量の異なる半導体メモリを着脱自在に装置するため容量設定スイッチ(11a),(11b),…を設けたが、固定方式の記憶装置の場合は省くことができ、また、容量設定スイッチ(11a),(11b),…などを設けずに、半導体メモリ(3)の容量にもとづく該半導体メモリ(3)の最終アドレスを演算処理回路(13)に自動的に入力することも勿論可能である。

さらに、半導体メモリ(3)のアクセス速度を変更しない場合は、各速度設定スイッチ(12a),(12b),…を省くことも可能である。

4　図面の簡単な説明

図面はこの発明の表示方法の1実施例のブロック図である。

(3)…半導体メモリ、(6)…カウンタ、(7)…アドレスバス、(11a),(11b)…容量設定スイッチ、(12a),(12b)…速度設定スイッチ、(13)…演算処理回路、(14)…時間表示部。

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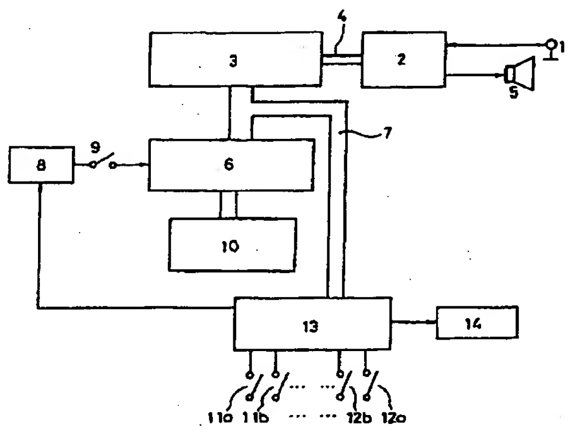
4
3
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11a
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12b
12a

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SPECIFICATION

1. Title of the Invention: ELECTRONIC SOUND RECORDING DEVICE

2. Claim of Japanese Utility Model Registration Application

An electronic sound-recording device:

encoding means for extracting and encoding at least musical scale of musical sound input from outside;

a semiconductor memory for storing musical-scale code encoded by the encoding means; musical-sound signal synthesizing means for performing conversion and synthesis to provide a predetermined musical signal in accordance with the musical-scale code read from the semiconductor memory; and

sound producing means for producing musical sound in accordance with the musical signal from the musical-sound signal synthesizing means.

3. Detailed Description of the Invention

[Technical Field of the Invention]

The present invention relates to an electronic sound-recording device capable of considerably reducing a memory capacity.

[Related Art]

In recent years, compact electronic equipment having a sound-recording function and having a configuration in which, when musical sound based on voice or musical sound obtained by playing a musical instrument is input from outside, the input musical sound as-is is digitally encoded and is recorded in a semiconductor memory and the recorded content is read from the semiconductor memory at alarm time or at arbitrary time for playback, is known.

[Problems of the Related Art]

However, in such a type of compact electronic equipment with a sound-recording function, the memory capacity is enormous since input musical sound is simply recorded and played back with fidelity. As a result, there are problems in that the cost and the capacity are increased.

[Object of the Present Invention]

The present invention has been made in view of the foregoing situations, and an object of the present invention is to provide an electronic sound-recording device capable of considerably reducing a memory capacity.

[Summary of the Invention]

In order to achieve the foregoing object, the present

invention has a feature in that at least musical scale of musical sound input from outside is extracted, encoded, and is written to a semiconductor memory, and during playback, in accordance with musical-scale code read from the semiconductor memory, conversion and synthesis are performed to provide a predetermined musical signal and sound is produced.

[Configuration of First Embodiment]

FIG. 1 shows a first embodiment of the present invention, and the configuration of a basic clock circuit will be described first. An oscillator circuit 1, a divider circuit 2, a time counter circuit 3 constitute a typical clock circuit. Time data output from the time counter circuit 3 is displayed on a display unit 5 via a display control circuit 4. Alarm time pre-stored by an alarm-time storing circuit 6 is displayed, through switching, on the display unit 5 via the display control circuit 4. Upon detecting a match between content of the time counter circuit 3 and content of the alarm-time storing circuit 6, a matching circuit 7 outputs an alarm signal AL to a control circuit 8. A predetermined frequency signal from the divider circuit 2 is input to the control circuit 8. Based on input data that is output from a switch operation unit 9 in accordance with an operation switch, the control circuit

8 controls various operations. For example, the control circuit 8 modifies the content of the time counter circuit 3, sets alarm time in the alarm-time storing circuit 6, and controls a switching operation of the display control circuit 4. In addition, when a record switch or playback switch provided at the operation unit 9 is operated, the control circuit 8 controls a record or playback operation.

Next, the circuit configuration of a sound-recording function will be described. A sound-recording function of this embodiment is adapted to record, as sound-record content, musical sound based on voice, musical sound obtained by playing a musical instrument, or the like. A musical-sound waveform signal input from a microphone 10 is amplified by an amplifier 11. Thereafter, from the amplified signal, high frequency components are removed by a low-pass filter 12, and the resulting signal is input to a musical-scale encoder circuit 13.

The musical-scale encoder circuit 13 includes a limiter 13a, a frequency counter 13b, and an encoder/converter circuit 13c. The limiter 13a shapes the waveform of an output of the low-pass filter 12. Using clock ϕ_1 transmitted from the divider circuit 2, the frequency counter 13b obtains counter-value data corresponding to the frequency of a musical-sound waveform signal from the limiter 13a. The encoder/converter circuit 13c encodes the counter-value data

from the frequency counter 13b into musical-scale code corresponding thereto. That is, the musical-scale encoder circuit 13 extracts only the musical scale (musical interval) components of an input musical-sound waveform signal and encodes the components into musical-scale code. Thus, the encoded musical-scale code is written to a semiconductor memory 15.

The semiconductor memory 15 is implemented with a RAM (random access memory) having a large capacity (e.g., 256 bits). Under the control of the control circuit 8, the writing or reading operation of musical-scale code is controlled. In accordance with address data transmitted from the control circuit 8 via an address circuit 16, the write or read address is specified. The musical-scale code written to the semiconductor memory 15 is read in accordance with the sequence of writing. When a 256 Kb RAM is used as the semiconductor memory 15, recording for 32 seconds is possible at a sampling of 8 KHz and recording for 64 seconds is possible at a sampling of 4 KHz. The musical-scale code read from the semiconductor memory 15 is input to a musical-sound synthesizer circuit 17.

The musical-sound synthesizer circuit 17 includes a waveform synthesizer circuit 17a and an amplitude modulator circuit 17b. The waveform synthesizer circuit 17a converts musical-scale code from the semiconductor memory 15 into a

corresponding analog frequency signal. The frequency signal is combined with sound input from the control circuit 8 via a waveform control circuit 18, and the resulting signal is modulated and input to the amplitude modulator circuit 17b. In accordance with amplitude data from the control circuit 8, the amplitude modulator circuit 17b amplifies and modulates an output of the waveform synthesizer circuit 17a. An output of the musical-sound synthesizer circuit 17 is sent to a low-pass filter 19 and is then sent to a speaker 21 via a mixer/amplifier circuit 20. The mixer/amplifier circuit 20 operates in accordance with an operation instruction from the control circuit 8. When an alert-sound signal other than recorded sound is input from a sound-source generator circuit 22, the speaker 21 produces sound other than recorded sound, i.e., produces alarm sound or time tone. In accordance with an alert-sound instruction output, every hour or at alarm time, from the control circuit 8, the sound-source generator circuit 22 sends the alert-sound signal to the mixer/amplifier circuit 20.

[Operation of First Embodiment]

Next, the operation of the sound-recording function of the first embodiment described above will be described. First, for recording sound, the record switch provided at the operation unit 9 is turned on. In response, the

musical-scale encoder circuit 13 is set to be in an operable state and the semiconductor memory 15 is addressed for writing. In this state, when musical sound is input to the microphone 10 through voice, a musical instrument, or the like, a musical-sound waveform signal input through the microphone 10 is input to the musical-scale encoder circuit 13 via the amplifier 11 and the low-pass filter 12. In the musical-scale encoder circuit 13, when the musical-sound waveform signal is input from the limiter 13a to the frequency counter 13b, counter-value data corresponding to the sound scale (frequency) thereof is output from the frequency counter 13b to the encoder/converter circuit 13c, from which the musical-scale code of the input musical sound is output. The musical-scale code output from the encoder/converter circuit 13 is written to a specified address area in the semiconductor memory 15. In this case, in the semiconductor memory 15, the specified address is sequentially updated in increments of "+1" in accordance with address data from the address circuit 16. Thus, in the order of input musical sound, only the musical-scale code thereof is sequentially written to the semiconductor memory 15.

Next, when content recorded in the semiconductor memory 15 in the manner described above is played back, the playback switch provided at the operation unit 9 is turned

on. In response, the musical-sound synthesizer circuit 17 and the mixer/amplifier circuit 20 are set to be in operable states and the semiconductor memory 15 is addressed for reading. As a result, musical-scale code is sequentially read from the semiconductor memory 15 in the order of writing and is input to the musical-sound synthesizer circuit 17. In the musical-sound synthesizer circuit 17, the musical-scale code read from the semiconductor memory 15 is converted by the waveform shaping circuit 17a into a corresponding analog frequency signal. Audio that is input from the control circuit 8 via the waveform control circuit 18 is combined with the converted frequency signal. In this case, for example, the waveforms are shaped so as to provide sound of the same musical instrument as the input musical sound or to provide sound of another musical instrument. Thus, an output of the waveform shaping circuit 17a is input to the amplitude modulator circuit 17b, so that the output is amplified and modulated. The resulting output is sent to the speaker 21 via the low-pass filter 19 and mixer/amplifier circuit 20, so that sound is produced.

As described above, in the present embodiment, for recording sound, only the musical scale components of input musical sound are extracted and are encoded into musical-scale code and only the musical-scale code is written to the semiconductor memory 15. Thus, the memory capacity can be

significantly reduced. In other words, the recording time can be significantly extended for memories having the same capacity. Also, a temporal change in a musical-sound waveform signal does not have to be recorded and only the frequency code thereof is recorded, so that the memory access rate during recording can be reduced. As a result, the circuit configuration can be simplified and the reliability is also improved. In addition, since the musical scale is digitally recorded, various types of musical-sound playback and synthesis can be achieved with ease. For example, recorded content not only can be played back but also can be converted into sound of an arbitrary musical instrument during playback, or automatic chorus in human voice can be achieved through synthesis and mixture of language information.

[Second Embodiment]

Next, a second embodiment of the present invention will be described with reference to FIG. 2.

While only the musical scale of an input musical sound is extracted, encoded, and written to the semiconductor memory 15 in the first embodiment, a sound volume is also written to the semiconductor memory 15 in addition to the musical scale in the second embodiment. In FIG. 2, what are configured in substantially the same manner as those shown

in FIG. 1 are denoted with the same reference numerals and the descriptions thereof are omitted. In the figure, 13d indicates a low-rate A/D (analog/digital) converter circuit, which encodes the amplitude of musical-sound waveforms output from the low-pass filter 12. The resulting converted amplitude code is written to the semiconductor memory 15. In this case, the semiconductor memory 15 is divided into a musical-scale code storing area and an amplitude-code storing area. The amplitude code is written so as to correspond to musical-sound code. In the present embodiment, a musical-scale encoding controller 14 is provided. The musical-scale encoding controller 14 has a frequency code/musical-sound code conversion table. The musical-scale encoding controller 14 refers to content of the converter table to perform correction calculation, thereby controlling the encoder/converter circuit 13c. Thus, musical-scale code, together with corresponding amplitude code, is read from the semiconductor memory 15. The amplitude code is converted by a low-rate D/A (digital/analog) converter circuit 17c into an analog output, which is input to an amplitude converter circuit 17b. In accordance with the output from the low-rate D/A converter circuit 17c, the amplitude converter circuit 17b modulates the amplitude.

In the second embodiment, as described above, while the musical volume of input musical sound is also recorded in

addition to the musical scale, the input musical scale as-is is not input. Thus, the present embodiment provides advantages that are substantially the same as those in the first embodiment. For example, the memory capacity can be reduced, the memory can also be accessed at a required arbitrary rate, and record/playback at a low rate can also be performed.

[Third Embodiment]

Next, a third embodiment of the present invention will be described with reference to FIG. 3.

In the third embodiment, as in the second embodiment, the amplitude code, together with the frequency code of input musical sound, can also be recorded and played back. In addition, the third embodiment is configured to allow selection of whether to perform playback in accordance with only recorded frequency code or to perform playback in accordance with amplitude code together with the frequency code. The selection is executed by a switch operation. In the present embodiment, semiconductor memories 18a and 18b specific for frequency code and amplitude code are provided, respectively, and address circuits 16a and 16b are provided so as to correspond to the semiconductor memories 18a and 18b. In addition, in the present embodiment, a frequency discriminator 22 is used to detect an input musical-sound

frequency, the detected frequency is encoded by an A/D converter circuit 23, and the resulting frequency code is written to the semiconductor memory 18a. The frequency code read from the semiconductor memory 18a is converted into an analog signal by a D/A converter circuit 24, the analog signal is input to a V-F (frequency-voltage) converter circuit 25, and the resulting signal is sent to the waveform synthesizer circuit 17a. In the present embodiment, although the frequency discriminator 22 is used, an F-V converter circuit or FM demodulator may be used.

In the present embodiment, as described above, during playback, the selection of recorded content is performed, i.e., the selection of whether to read only frequency code or to read amplitude code together with frequency code is performed to perform playback. Thus, for example, when musical sound played for composing music or the like is temporarily stored as musical-scale information and is subsequently played back for writing a musical score, it is sufficient to play back only the musical scale during the playback. Thus, it is possible to perform playback in accordance with an application. The third embodiment also provides advantages substantially the same as those in the first embodiment.

Any system, such as a PCM (pulse code modulation) system, a DM (delta modulation) system, an ADM (adaptive

delta modulation) system, a DPCM (differential pulse code) system, an ADPCM (adaptive pulse code) system, or a PARCOR system, may be used as the recording system.

Although a 256 Kb RAM has been described as the semiconductor memory in the above-described embodiments, a 1 Mb RAM may be used. In this case, when sampling is performed on a 1 Mb RAM at 4 KHz, the recording time is 4 minutes. Also, a plurality of RAMs may be provided. For example, when three 1 Mb RAMs are used, the recording time is 12 minutes. Moreover, when 4 Mb RAMs are used, the recording time is further increased.

In the embodiments described above, although no particular description has been given of display, for example, the recording time, remaining time, recording capacity, or remaining capacity may be displayed in a graph form or a digital form.

Furthermore, although the description in the embodiments described above has been given of an electronic clock having a sound-recording function, it may a compact electronic calculator or the like. Naturally, it may be a sound-recording device itself.

[Advantages of the Invention]

As described above in detail, in the present invention, since at least the musical scale of musical sound input from

outside is extracted, encoded, and input to the semiconductor memory, the memory capacity can be significantly reduced compared to a case in which the waveforms of input musical sound is directly encoded and recorded. In addition, the access rate of the memory can be reduced, thus making it possible to simplify the circuit configuration. Furthermore, since the musical scale is digitally recorded, the musical scale not only can be played back but also can be converted into sound of an arbitrary musical instrument. Thus, it is possible to perform various types of musical-sound playback, depending on an application.

4. Brief Description of the Drawing

FIG. 1 is a circuit diagram of an electronic clock with a sound-recording function, showing a first embodiment of the present invention;

FIG. 2 is a circuit diagram of an electronic clock with a sound-recording function, showing a second embodiment of the present invention; and

FIG. 3 is a circuit diagram of an electronic clock with a sound-recording function, showing a third embodiment of the present invention.

10 ... microphone, 13 ... musical-scale encoder circuit, 13a ... limiter, 13b ... frequency counter, 13c ...

encoder/converter circuit, 15 ... semiconductor memory, 17 ... musical-sound synthesizer circuit, 21 ... speaker, 22 ... frequency discrimination unit, 23 ... A/D converter circuit

aa: FIG. 1

bb: CIRCUIT DIAGRAM OF ENTIRE ELECTRONIC CLOCK WITH SOUND-RECORDING FUNCTION

cc: MUSICAL-SCALE CODE

1: OSCILLATOR

2: DIVIDER

3: TIME COUNTER

6: ALARM TIME

7: MATCH

8: CONTROL CIRCUIT

9: OPERATION UNIT

13a: LIMITER

13b: FREQUENCY COUNTER

13c: MUSICAL-SCALE CODE ENCODER

17a: WAVEFORM SYNTHESIZER

17b: AMPLITUDE MODULATOR

18: WAVEFORM CONTROL

22: SOUND-SOURCE GENERATOR CIRCUIT

dd: FIG. 2

ee: CIRCUIT DIAGRAM OF ENTIRE ELECTRONIC CLOCK WITH SOUND-RECORDING FUNCTION

1: OSCILLATOR

2: DIVIDER

3: TIME COUNTER

6: ALARM TIME

7: MATCH

8: OPERATION UNIT

9: CONTROL CIRCUIT

13a: LIMITER

13b: FREQUENCY COUNTER

13c: ENCODER

13d: LOW-RATE A/D

17a: WAVEFORM SYNTHESIZER

17b: AMPLITUDE MODULATOR

17c: LOW-RATE D/A

18: WAVEFORM CONTROL

22: SOUND-SOURCE GENERATOR CIRCUIT

ff: FIG. 3

gg: CIRCUIT DIAGRAM OF ENTIRE ELECTRONIC CLOCK WITH SOUND-RECORDING FUNCTION

hh: FREQUENCY CODE

ii: AMPLITUDE CODE

1: OSCILLATOR

2: DIVIDER

3: TIME COUNTER

4: DISPLAY CONTROL

6: ALARM TIME

7: MATCH

8: CONTROL CIRCUIT

9: OPERATION UNIT

13a: LIMITER

13d: LOW-RATE A/D

22: FREQUENCY DISCRIMINATION UNIT

25: V-F CONVERTER

17a: WAVEFORM SYNTHESIZER CIRCUIT

17b: AMPLITUDE MODULATOR

17c: LOW-RATE D/A

18: MUSICAL-SCALE WAVEFORM OSCILLATOR CIRCUIT

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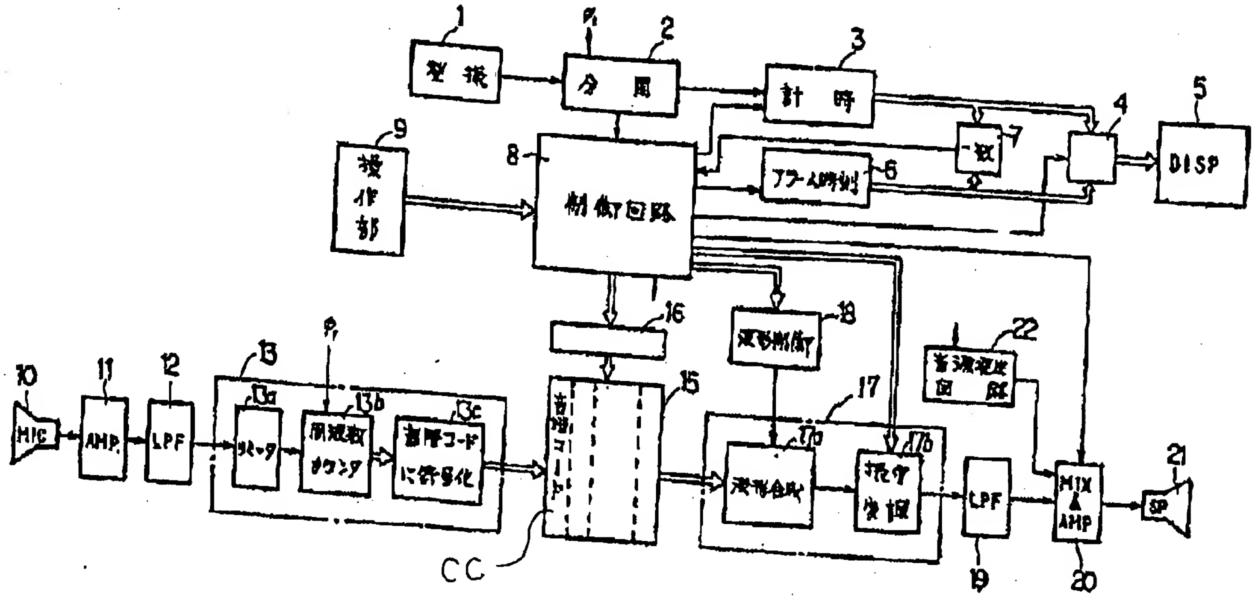

bb 録音機能付電子時計の全体回路構成図

第 1 図

aa

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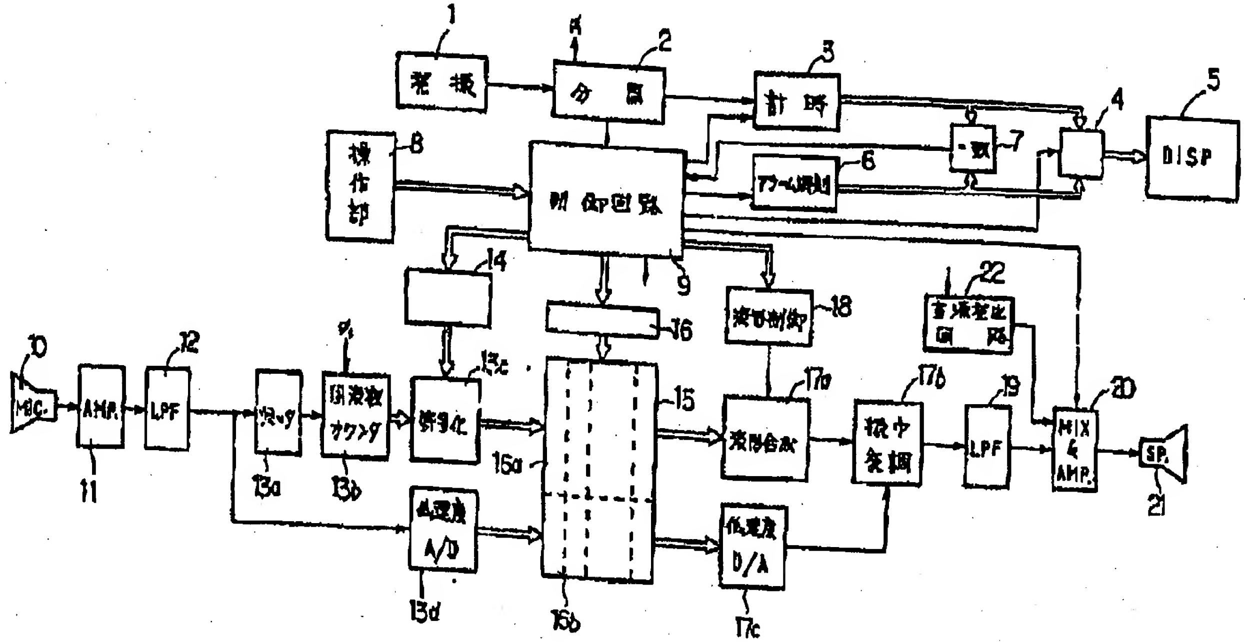

ee 録音機能付電子時計の全体回路構成図

dd 第 2 図

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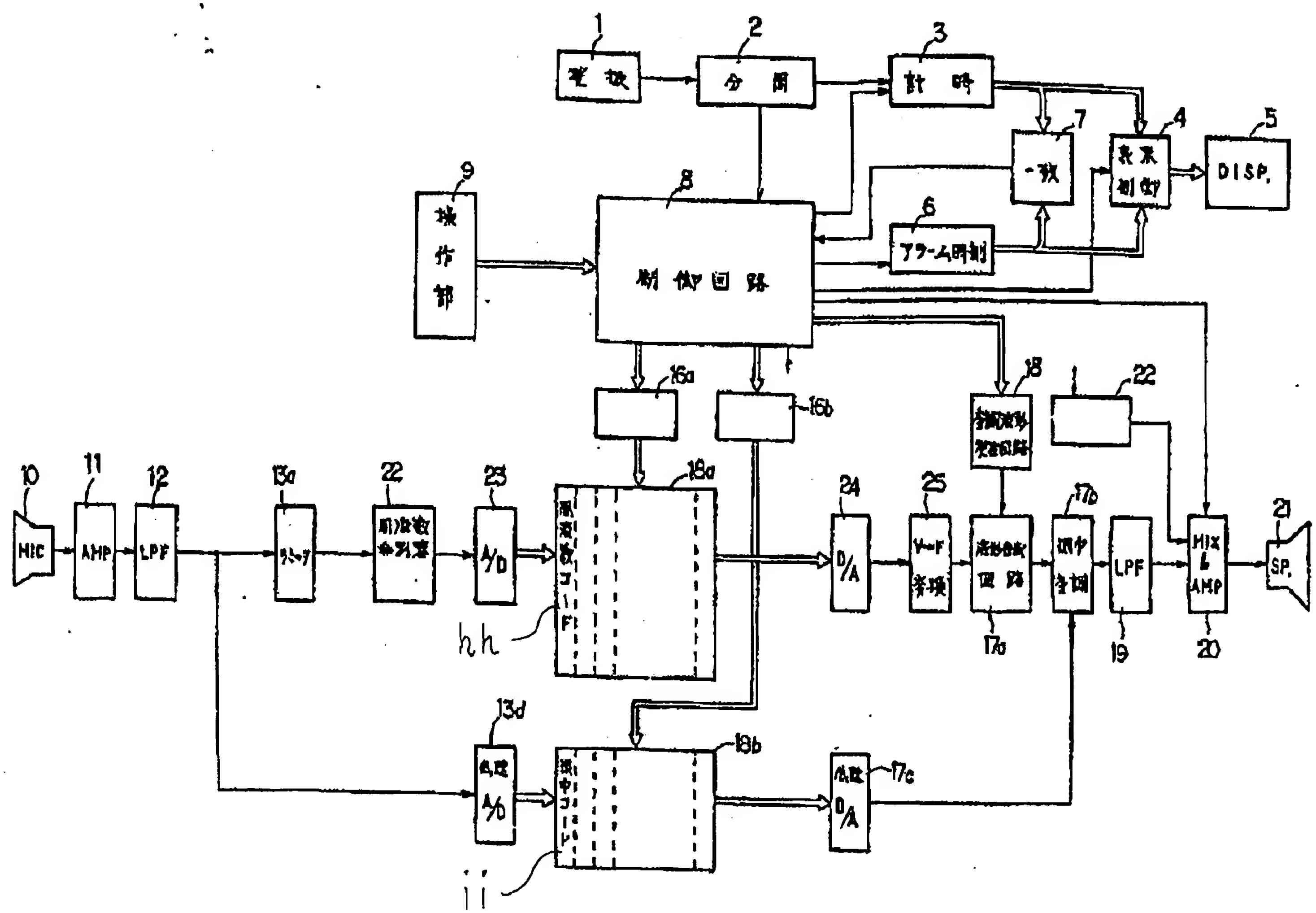

gg 録音機能付電子時計の全体回路構成図

第 3 図

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